

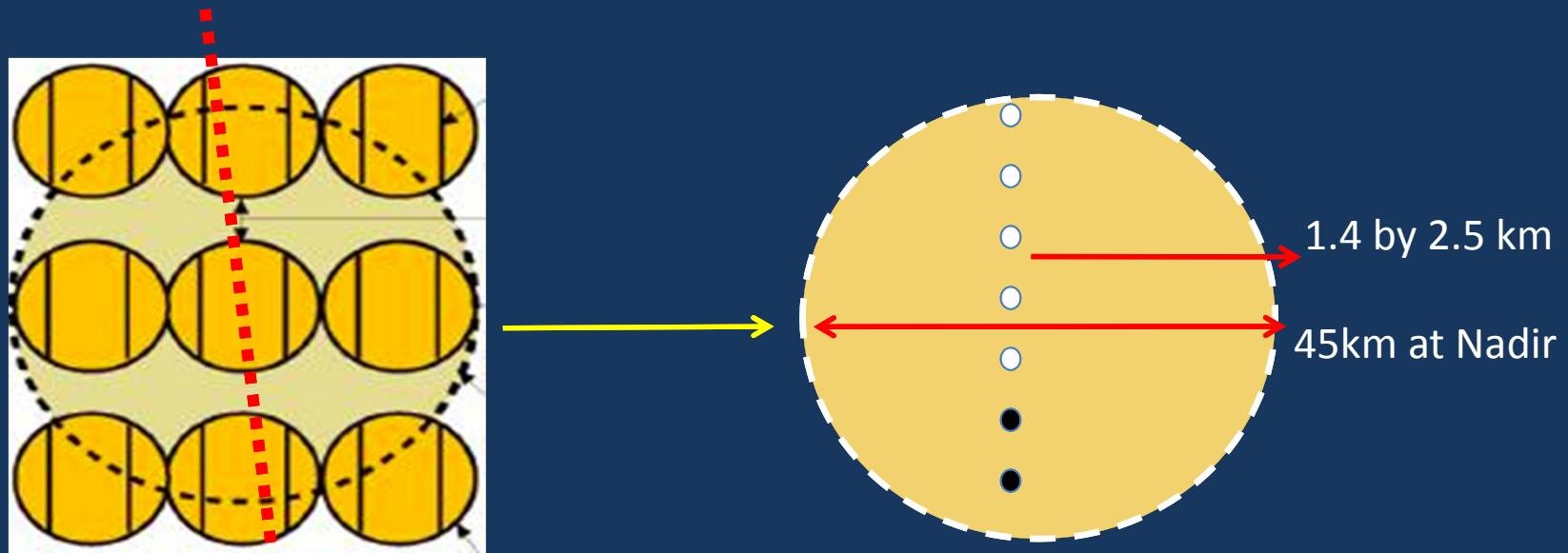
Diagnosing AIRS Sampling with CloudSat Cloud Classes

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sponsorship acknowledged.

Collocated AIRS, CloudSat, and ECMWF Model Analyses

Thanks to NASA MEaSUREs Program



- Data period: 07/2006 ~ 07/2007, globally from 65°S to 65°N
- Cloud class in AIRS/AMSU FOV: single type
- AIRS T and q (V5 L2 Support Product)
- ECMWF model analyses collocated spatially and temporally.
- Collocated ECMWF analyses sub-sampled with AIRS quality control flag.
- AIRS PBest Yield: percentage of AIRS *PBest* $\leq P(z)$ retrievals
- AIRS PGood Yield: percentage of AIRS *PGood* $\leq P(z)$ retrievals

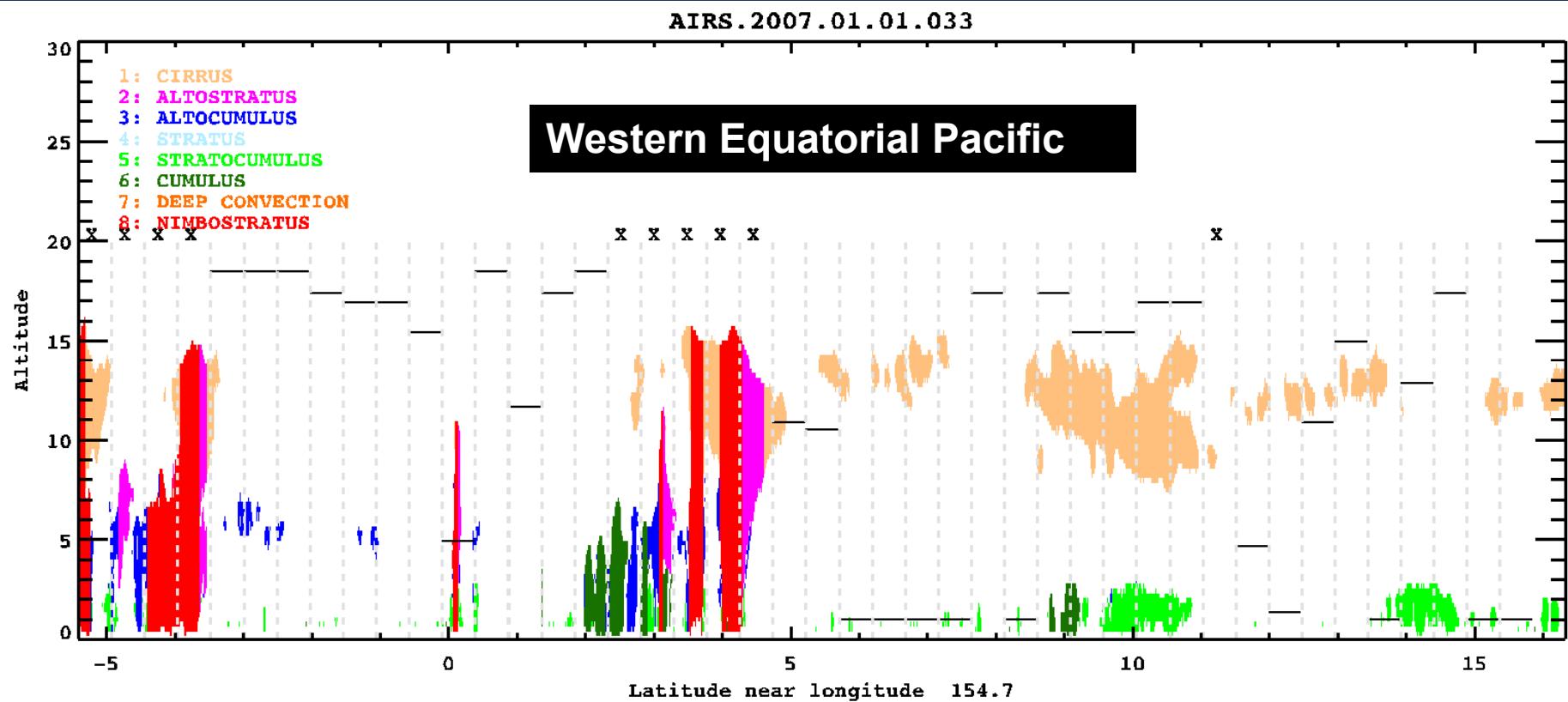
AIRS-CloudSat Matched Data

Color fill: CloudSat Classes (Sassen and Wang, 2008, GRL)

Gray verticals: matched AIRS profile boundaries.

Black horizontals: AIRS ‘best’ retrieval altitude (from ‘PBest’).

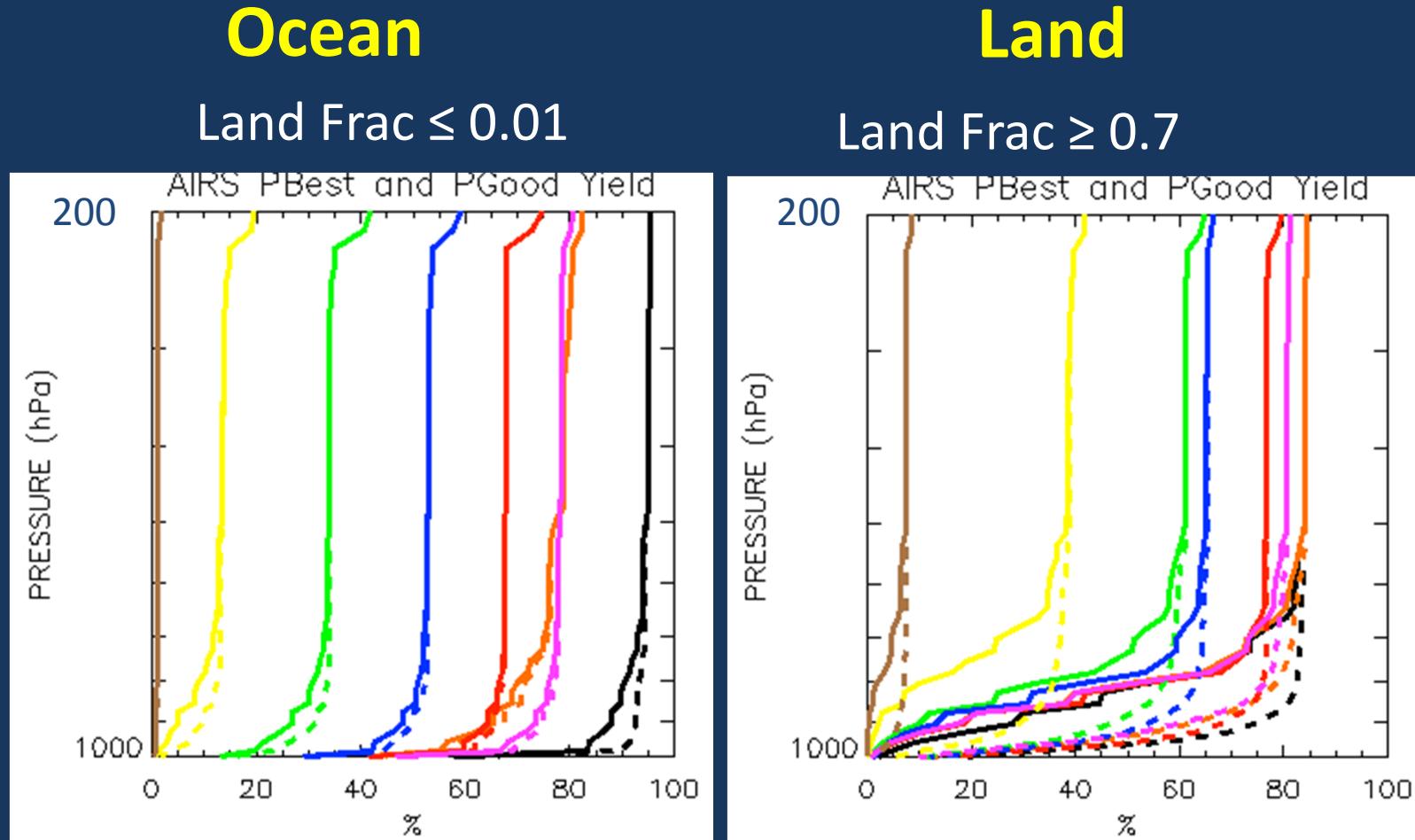
X: no AIRS tropospheric profiling.



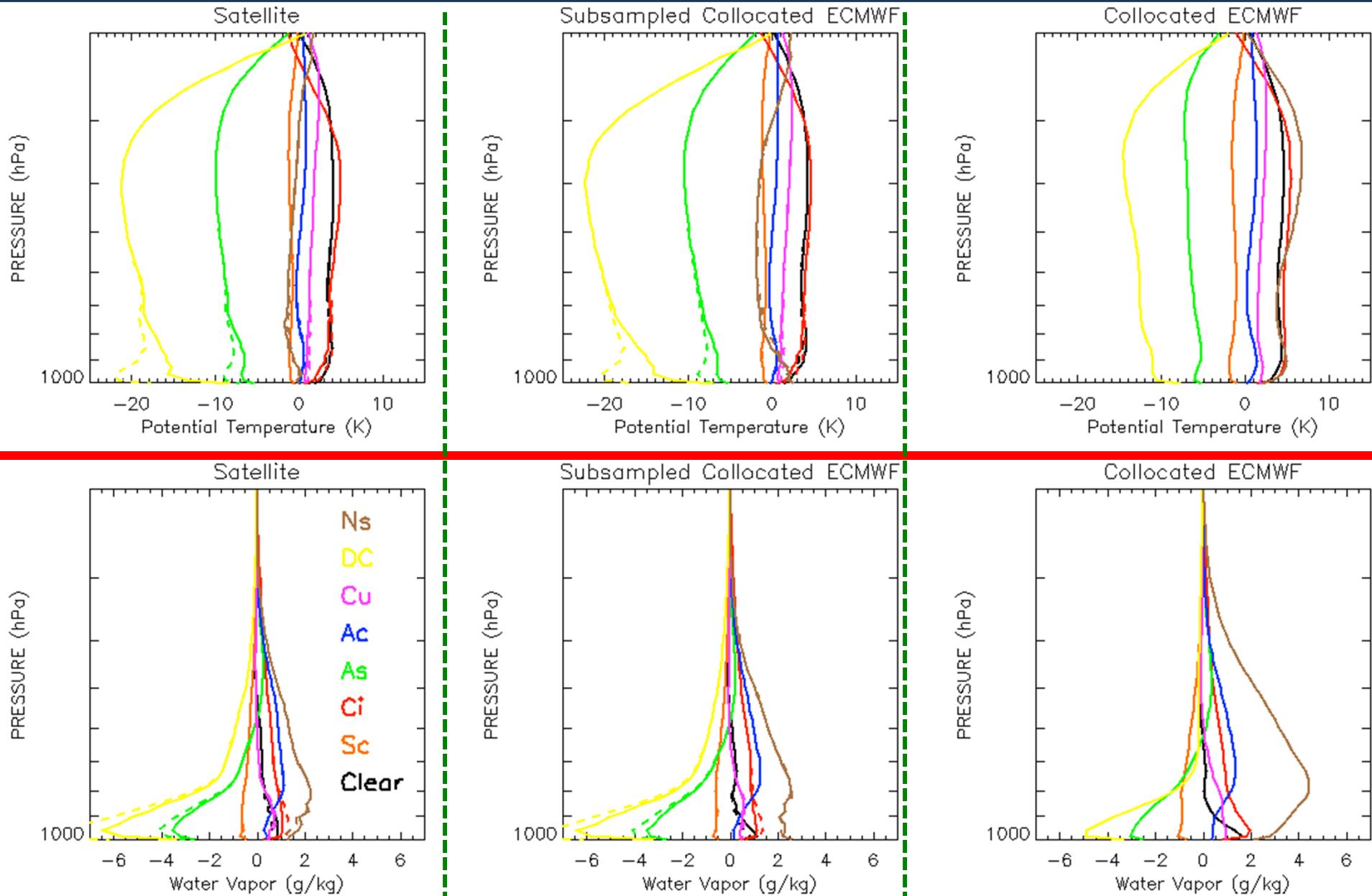
AIRS Yield by CloudSat Cloud Type

Global Land vs. Ocean

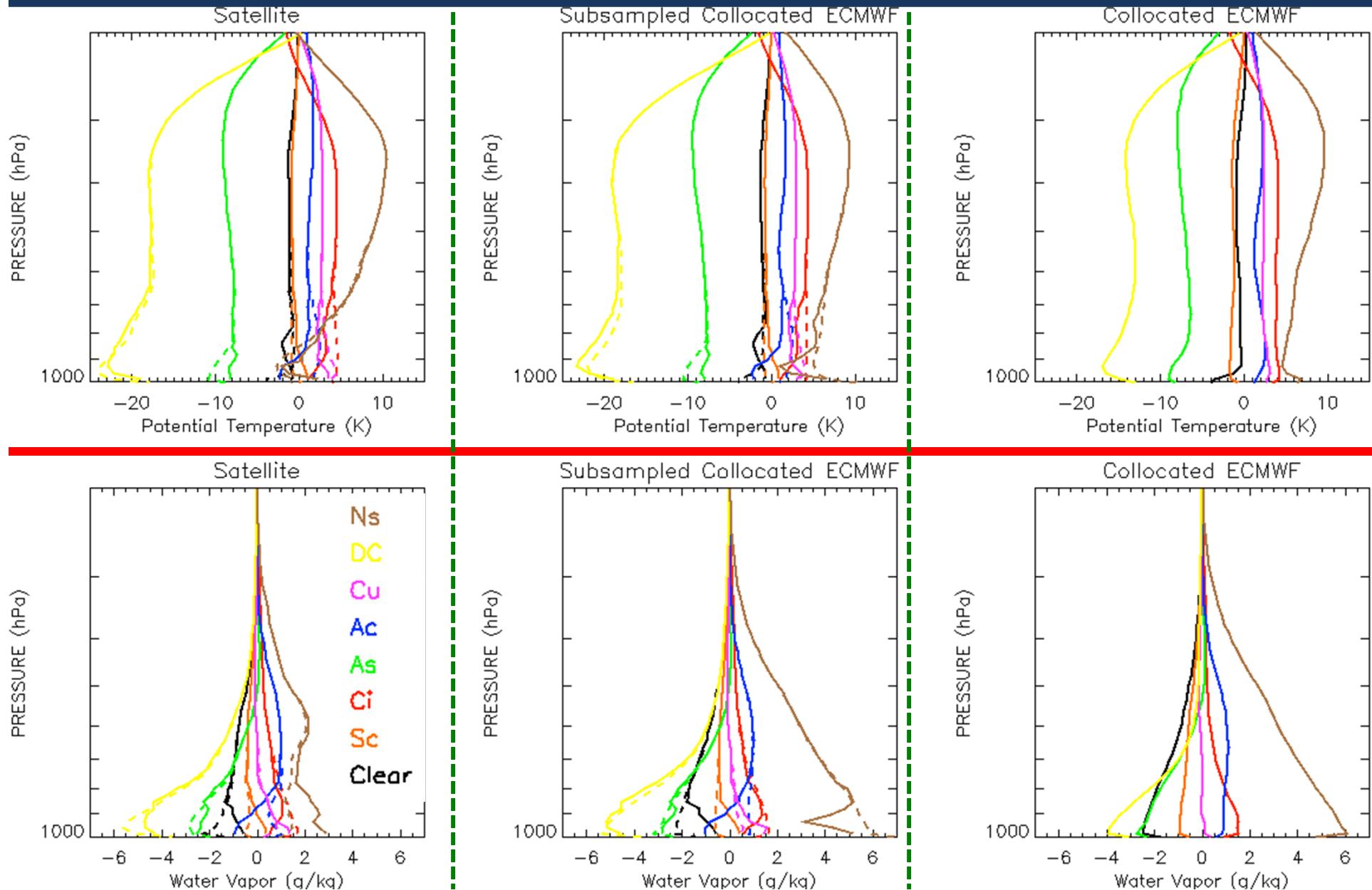
— Yield= percentage of PBEST \leq Pressure(z)
- - - Yield= percentage of PGOOD \leq Pressure(z)



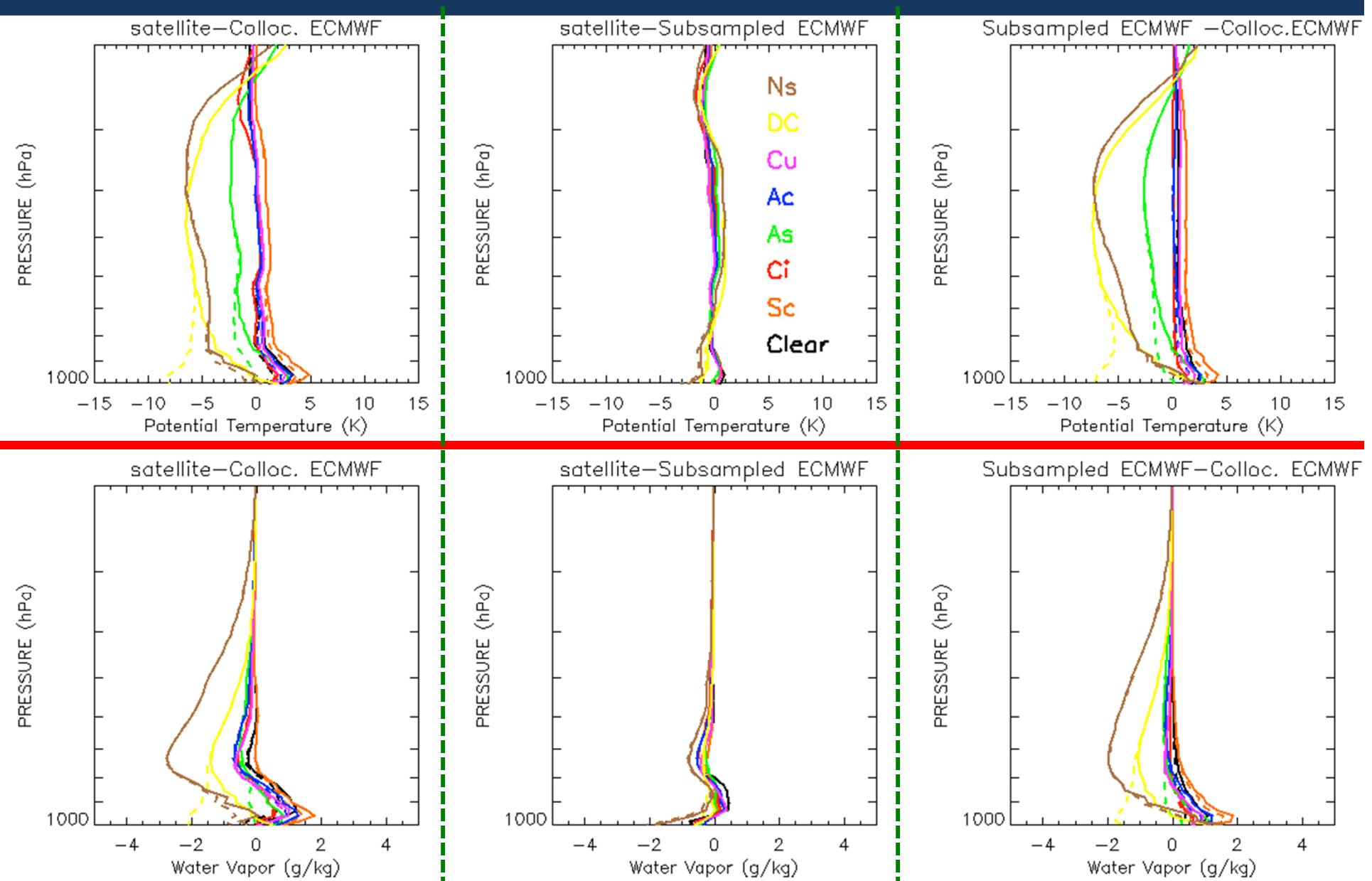
Range of Conditions Sampled by AIRS, by Cloud Type over Ocean (θ, q)



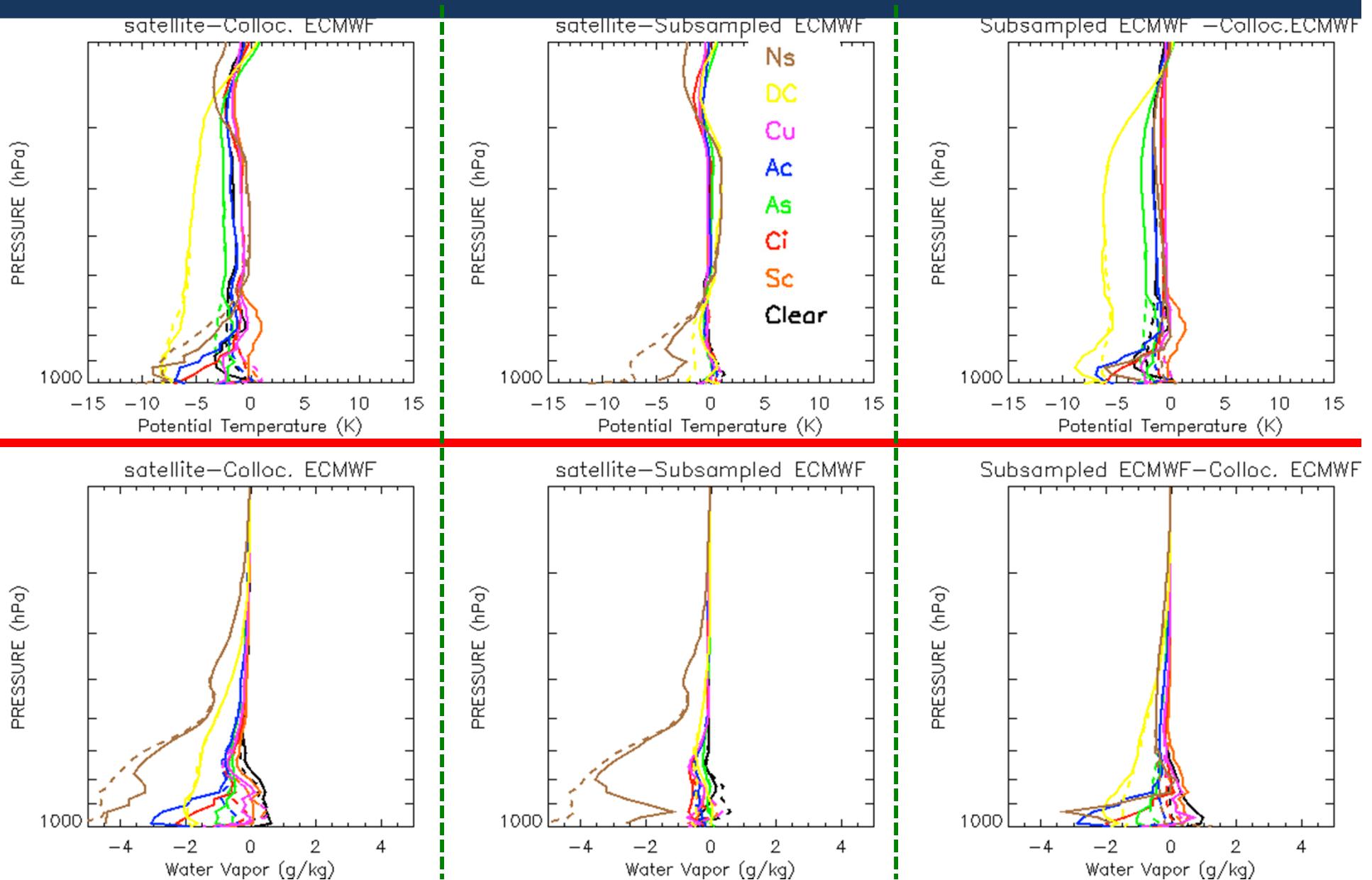
Range of Conditions Sampled by AIRS, by Cloud Type over Land (θ, q)



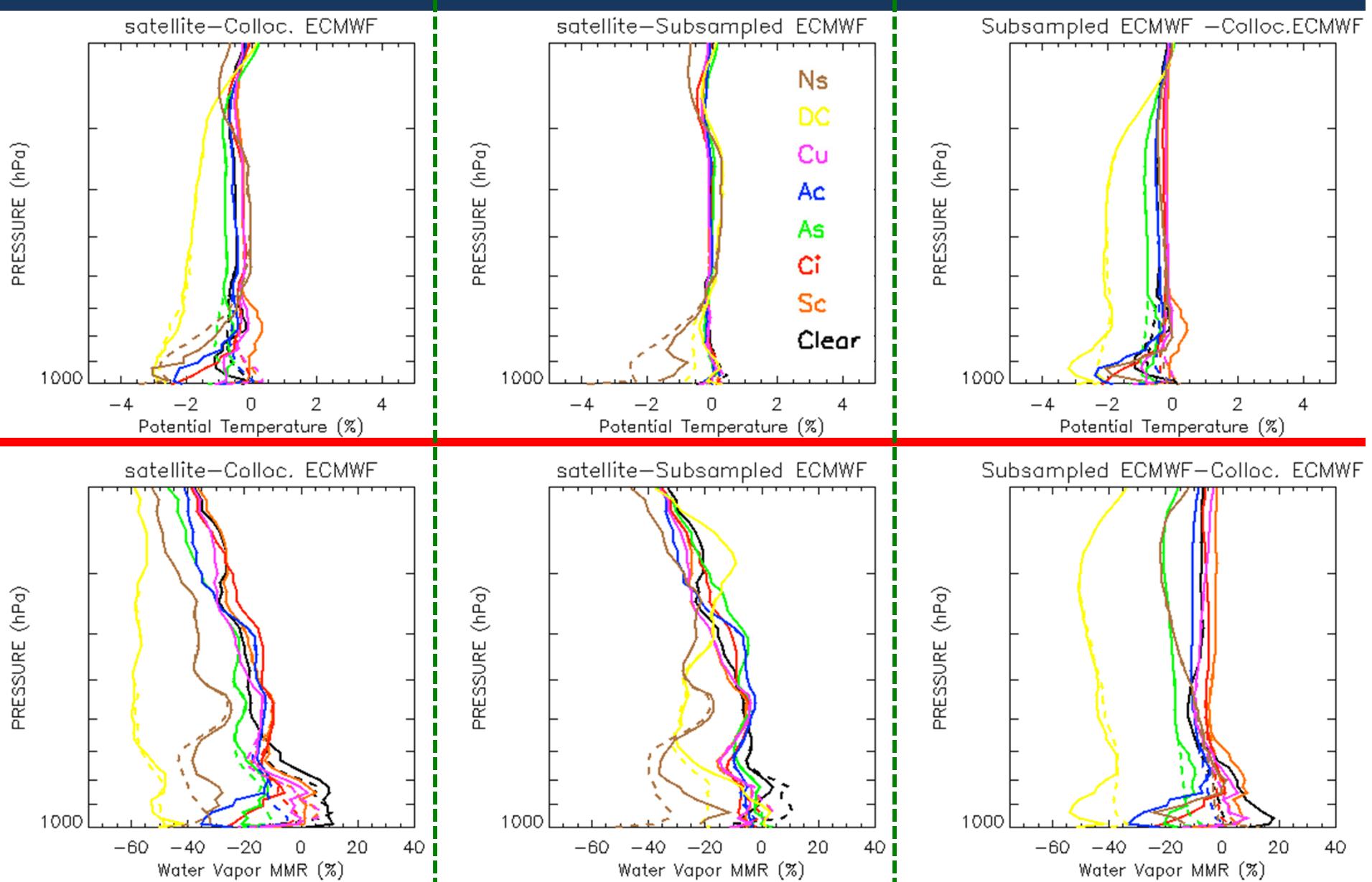
Ocean Abs. Difference of AIRS and ECMWF θ , q by Cloud Type



Land Abs. Difference of AIRS and ECMWF θ , q by Cloud Type

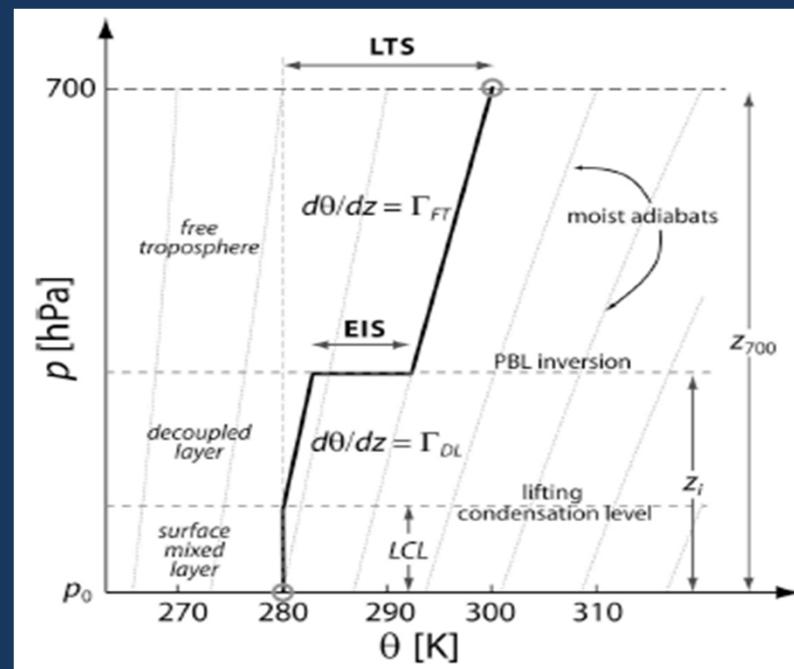


Ocean Differences Relative to True ECMWF Mean



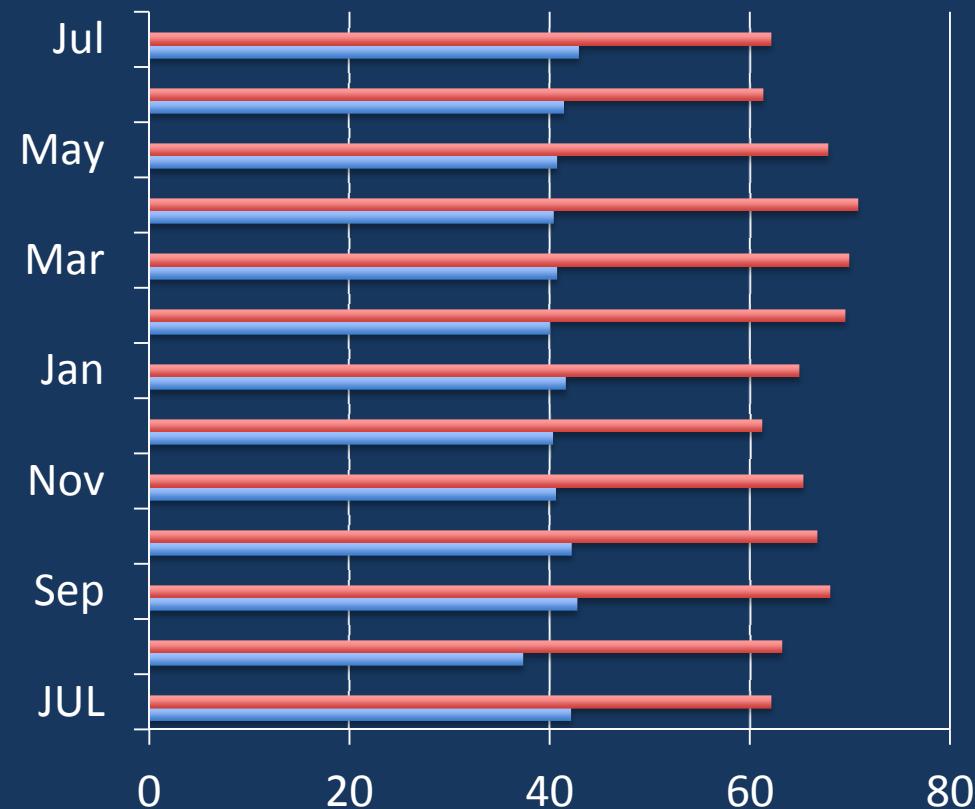
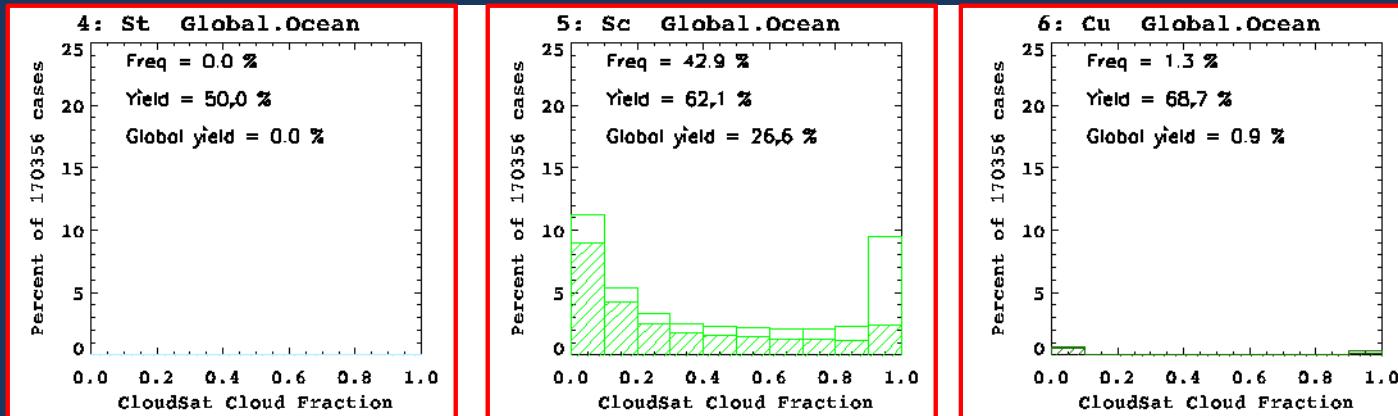
Creating Climatologies

- Apply sampling experience to study boundary layer structure from AIRS.
 - LTS = Lower tropospheric stability (Klein & Hartman, 1993)
 - EIS = estimated inversion strength (Wood and Bretherton, 2006)



Using This Dataset on MBL Study

CloudSat MBL Cloud Types

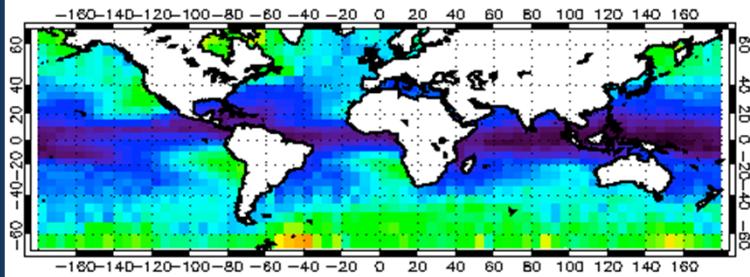


Method by Fetzer 2008

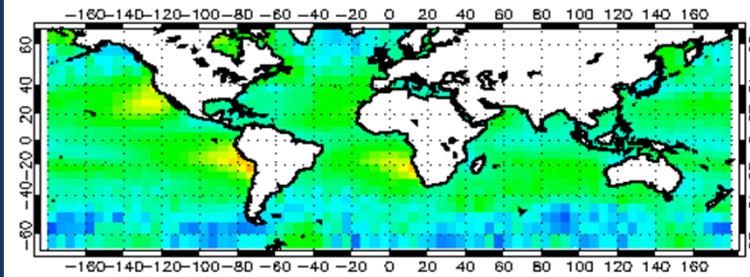
2007 July 01~31, Global Ocean

Annual EIS and LTS over Global Ocean

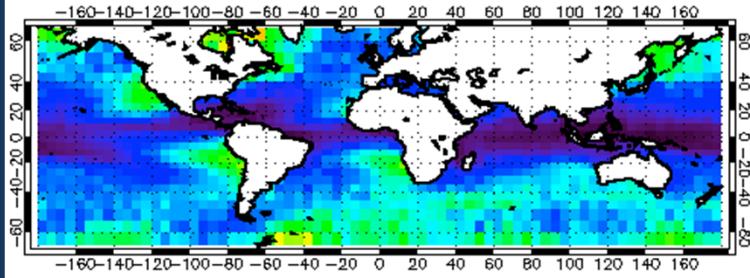
Satellite EIS



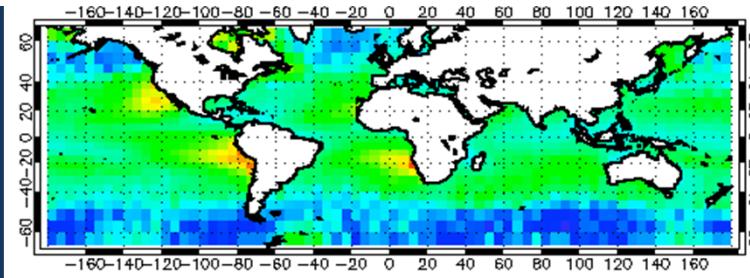
Satellite LTS



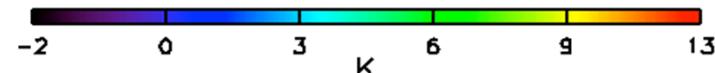
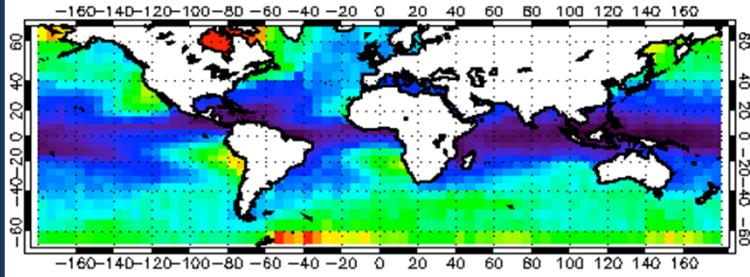
PBest Collocated ECMWF Analysis EIS



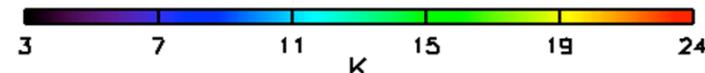
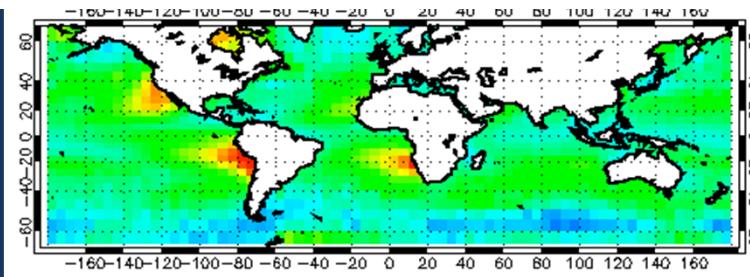
PBest Collocated ECMWF Analysis LTS



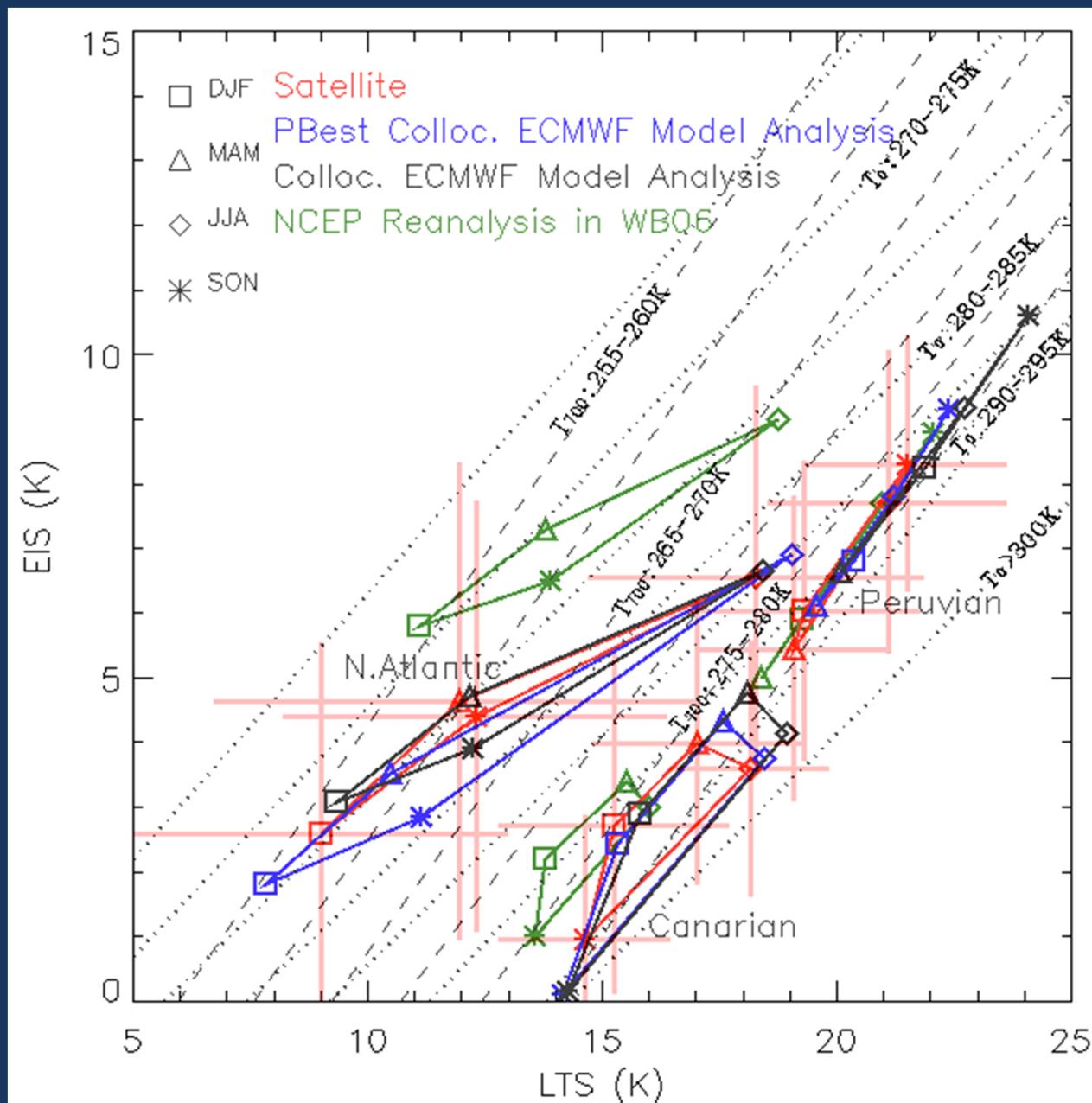
Collocated ECMWF Analysis EIS



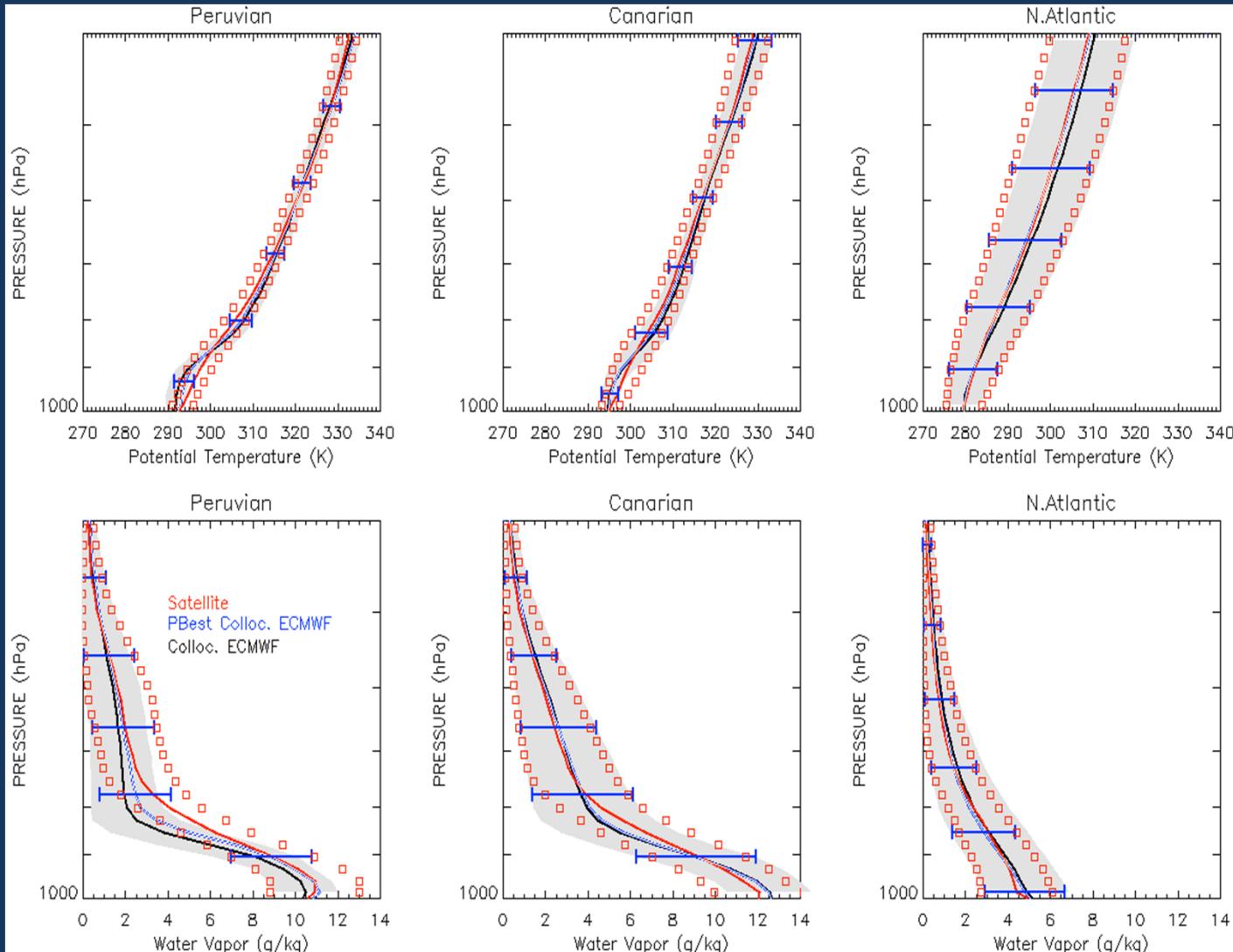
Collocated ECMWF Analysis LTS



Regional Relationships Between ELS and LTS



Regional θ and q Profiles for CloudSat MBL Clouds



Summary

- AIRS yield and sampling vary with cloud state. Careful utilization of collocated multiple satellite sensors is necessary.
- Profile differences between AIRS and ECMWF model analyses indicate that AIRS has high sampling and excellent accuracy for certain meteorological conditions.
- Cloud-dependent sampling biases may have large impact on AIRS L2 and L3 data in climate research.
 - MBL clouds / lower tropospheric stability relationship is one example.
- AIRS and CloudSat reveal a reasonable climatology in the MBL cloud regime despite limited sampling in stratocumulus
 - Thermodynamic parameters such as EIS derived from AIRS data map these cloud conditions successfully.
- *We are working on characterizing AIRS scenes with mixed cloud types.*